



Modelling Salmonella transfer during grinding of meat

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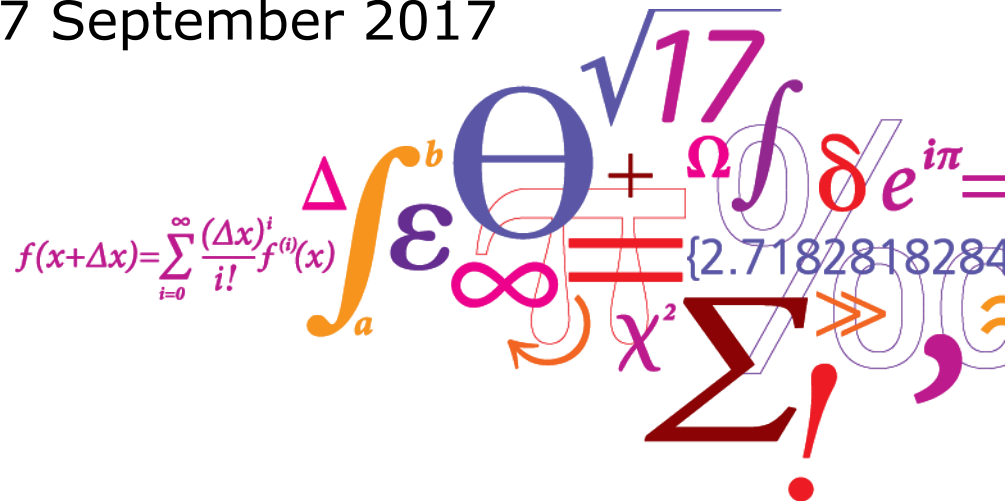
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Modelling *Salmonella* transfer during grinding of meat

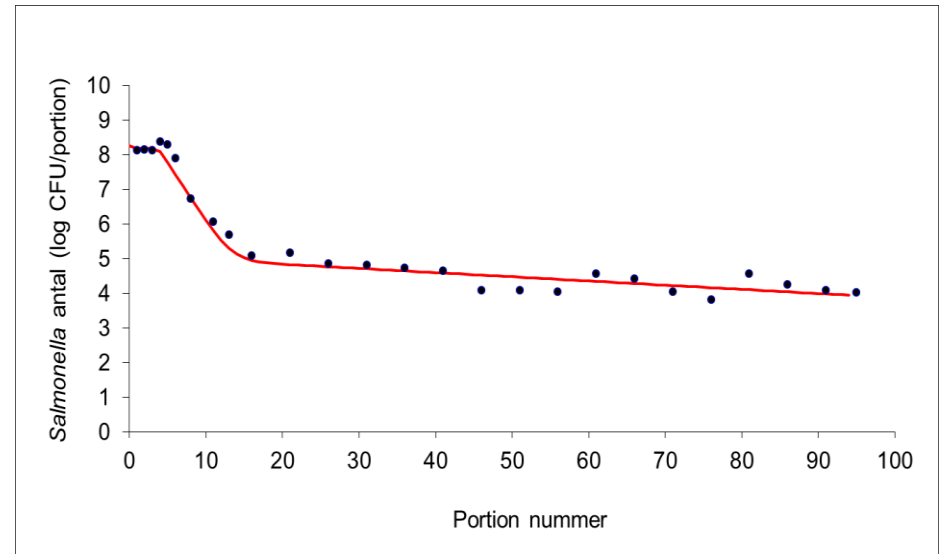
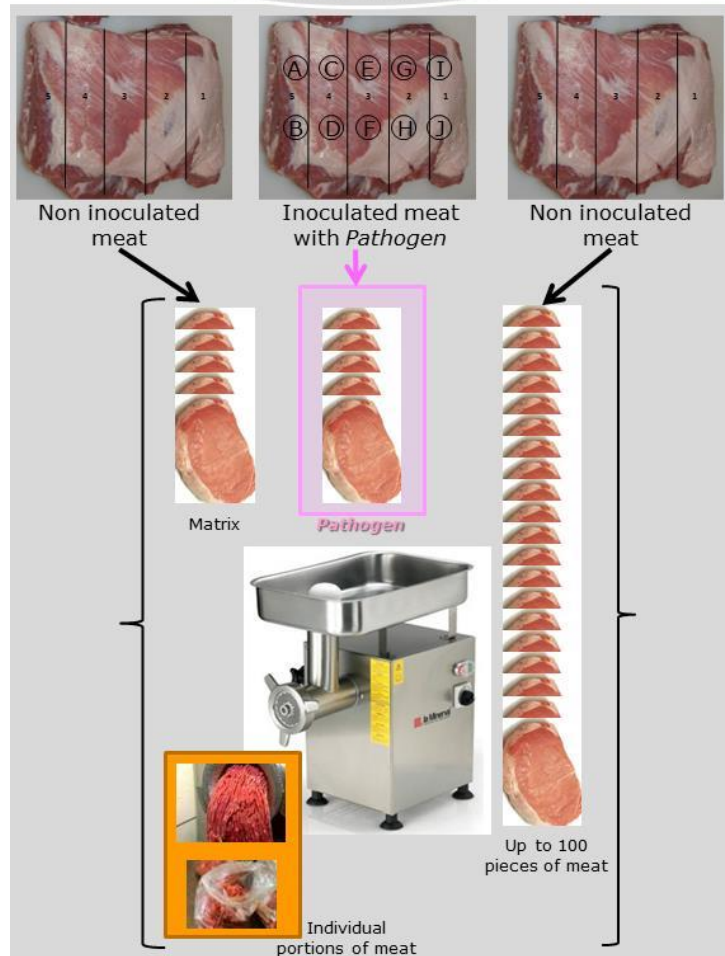
Tina Beck Hansen

MeatCrossCon final seminar, 7 September 2017



Background

Møller et al. (2012)



$$\begin{cases} M_i = (1-a_1)(1-a_2)(1-c_2) P_i + (b_1 \text{ gr}_{1,i-1}) + (b_2 \text{ gr}_{2,i-1}) \\ \text{gr}_{1,i} = a_1 P_i + (1-b_1) (1-c_1) \text{ gr}_{1,i-1} \\ \text{gr}_{2,i} = a_2 P_i + (1-b_2) (1-c_3) \text{ gr}_{2,i-1} \end{cases} \quad \text{Equation 1}$$

a_1	b_1	a_2	b_2	$1 - c_3$
0.0010	0.0275	0.8909	0.0558	0.4887

Research question

Can this promising transfer model be successfully applied to any condition of meat grinding?

- For different types of meat?
- For different types of grinders?
- For variable sizes and numbers of meat pieces?

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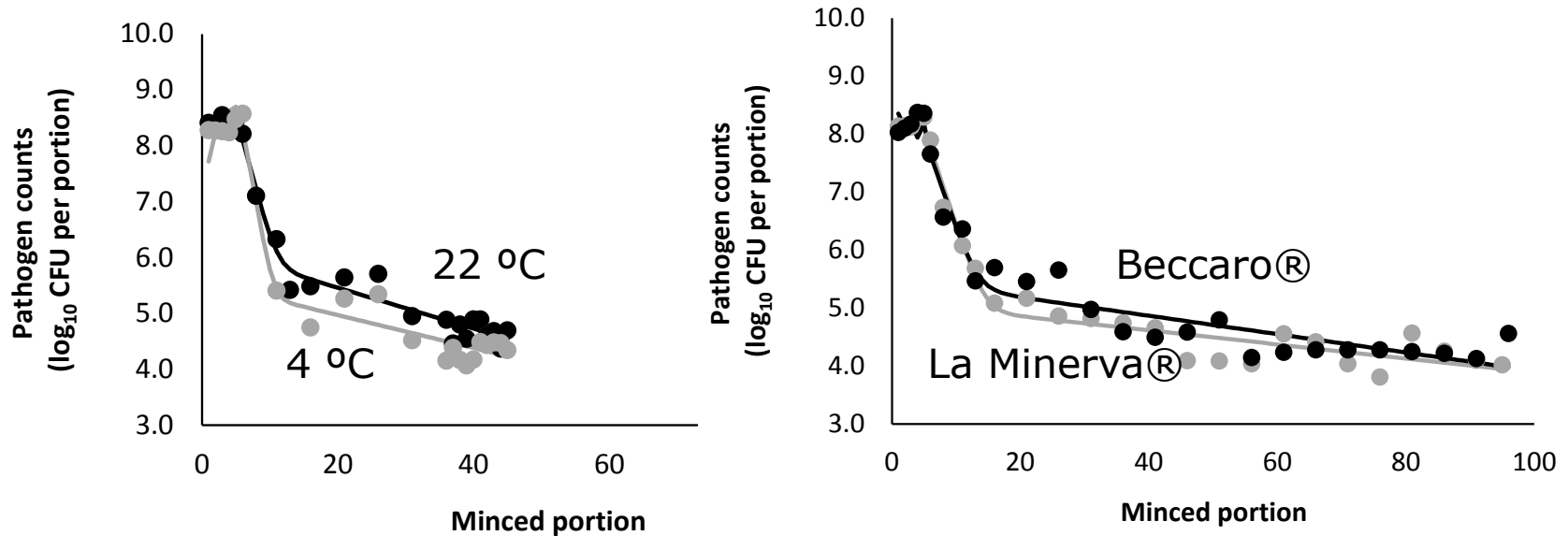
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Data

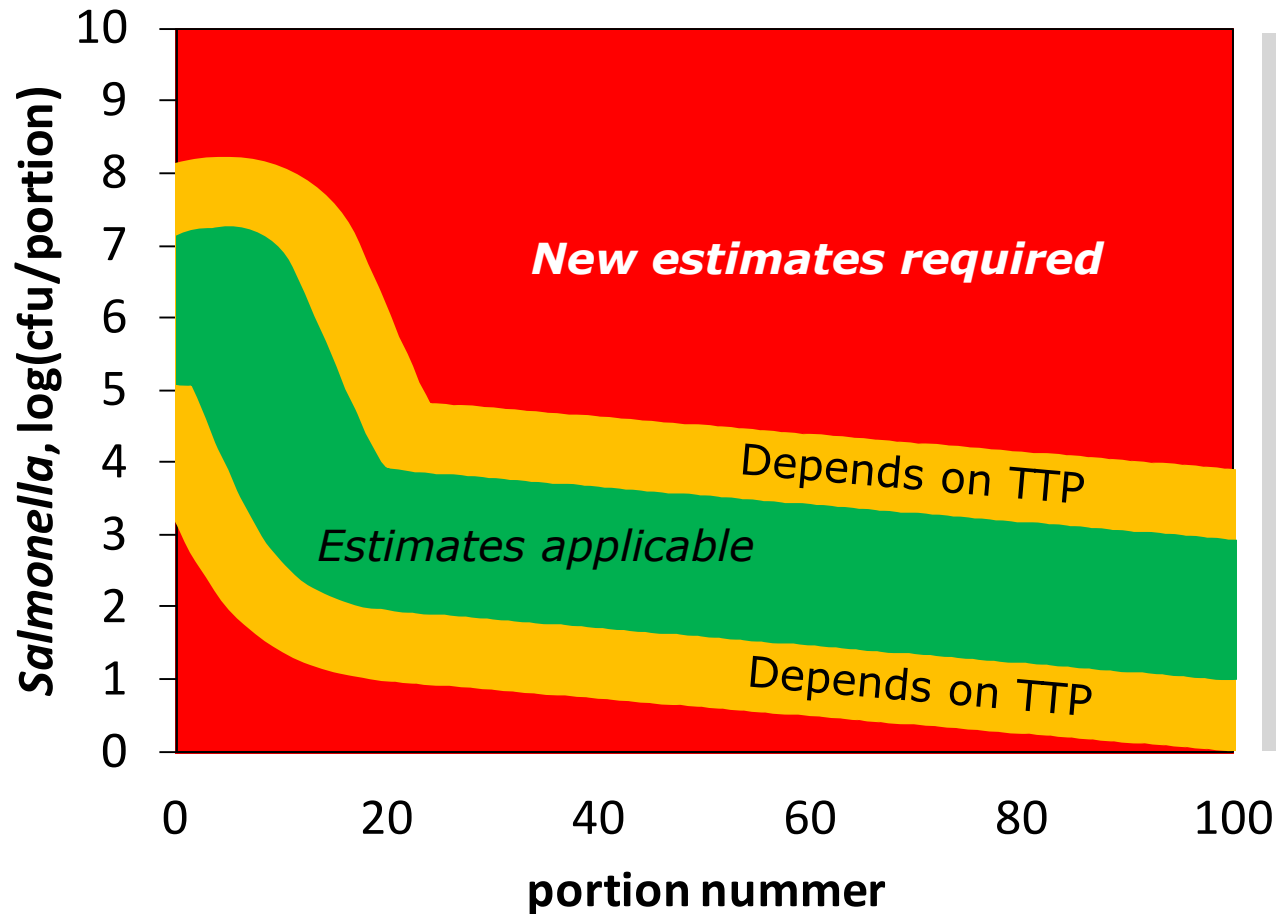
- 19 transfer trials
 - 11 from Brazil
 - 8 from Denmark, of which 3 were from Møller et al. (2012)
- Variables?
 - Grinder (Beccaro® and La Minerva®)
 - Number of meat pieces to be grinded (15 – 100)
 - Size of meat pieces (50 – 324 g)
 - Type of meat (pork and beef)
 - Temperatures (4 and 22 °C)
- Evaluation?
 - Pairwise comparison

Evaluation criterion?



- Not only a statistical difference
- Also a practical difference
- A link between transfer dynamics and risk of salmonellosis
- QMRA model for meatballs by Møller et al. (2015)

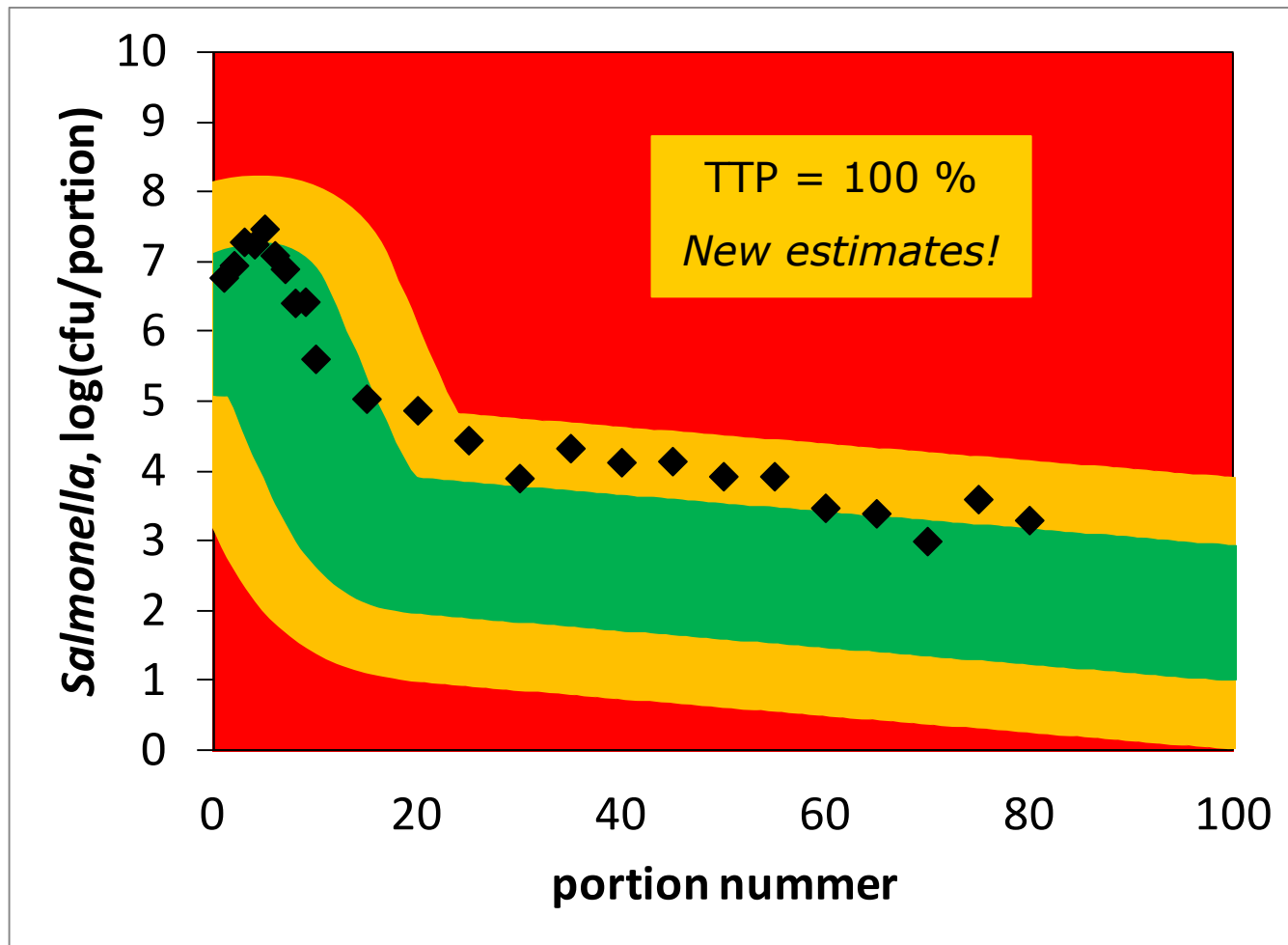
A new stepwise "risk-based" principle



1. Plot new obs.
2. $\geq 95\%$ obs. in **green**: model OK
3. $< 95\%$ obs. in **green** + **yellow**: NEW
4. $\geq 95\%$ obs. in **green** + **yellow**: calculate TTP
(Total Transfer Potential in %)

TTP > 50 %:
New estimates

Example using the new evaluation principle



Lessons learned

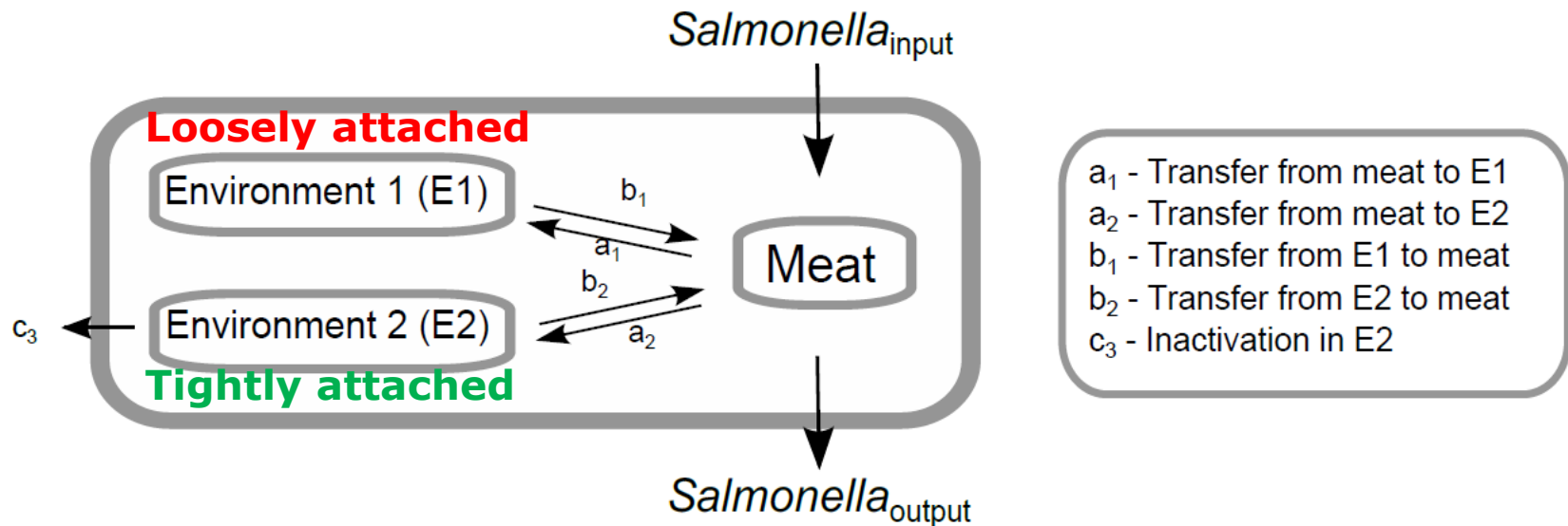
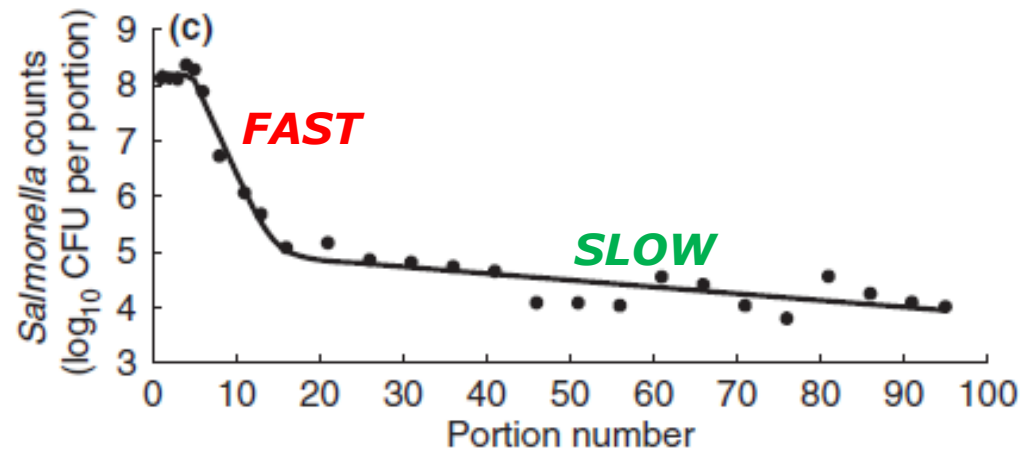
- 9 of 18 trials could **NOT** be described using parameter estimates from Møller et al. (2012)
 - Sharpness of grinder knife
 - Type of grinder
 - Sizes of meat pieces to be ground
 - Temperature
 - Number of meat pieces being ground
- Influence the dynamics of transfer

Relevant for
parameter
estimation

BUT - all trials were
successfully described
with the **equation**

Hypothesis

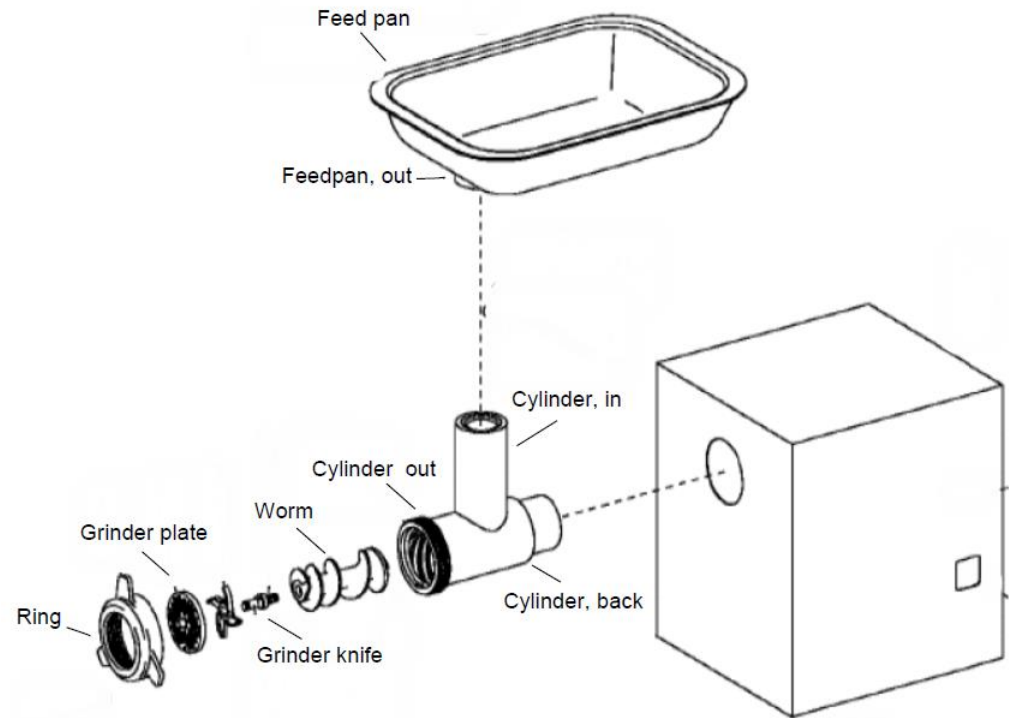
- Transfer shows tailing phenomenon
- which can be explained assuming two “compartments” inside meat grinder



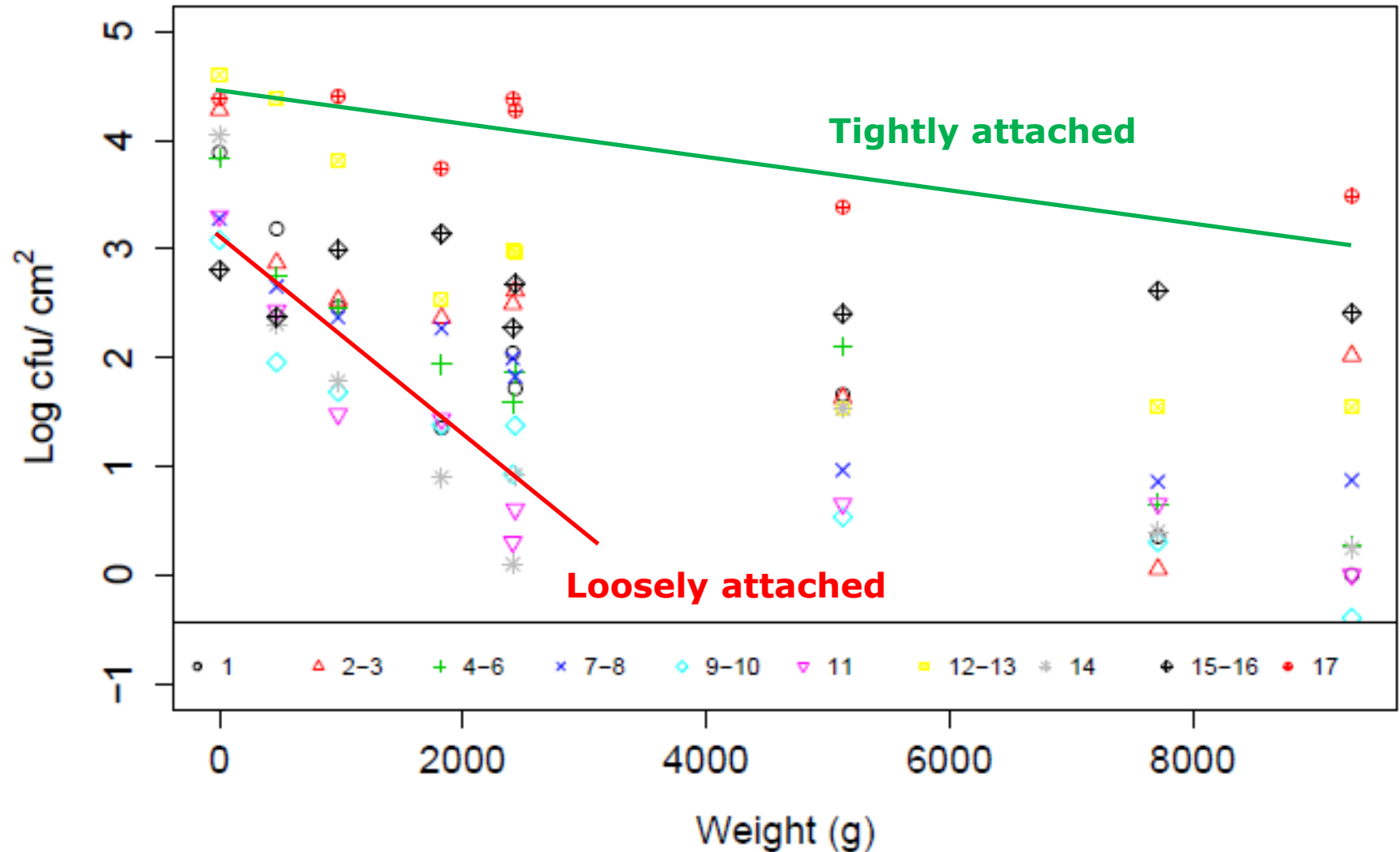
Aim

- To examine the meat grinder and attempt to identify loci with **loosely** or **tightly** attached *Salmonella*
- By investigating how many *Salmonella* we could recover (swabs) from 17 loci during grinding

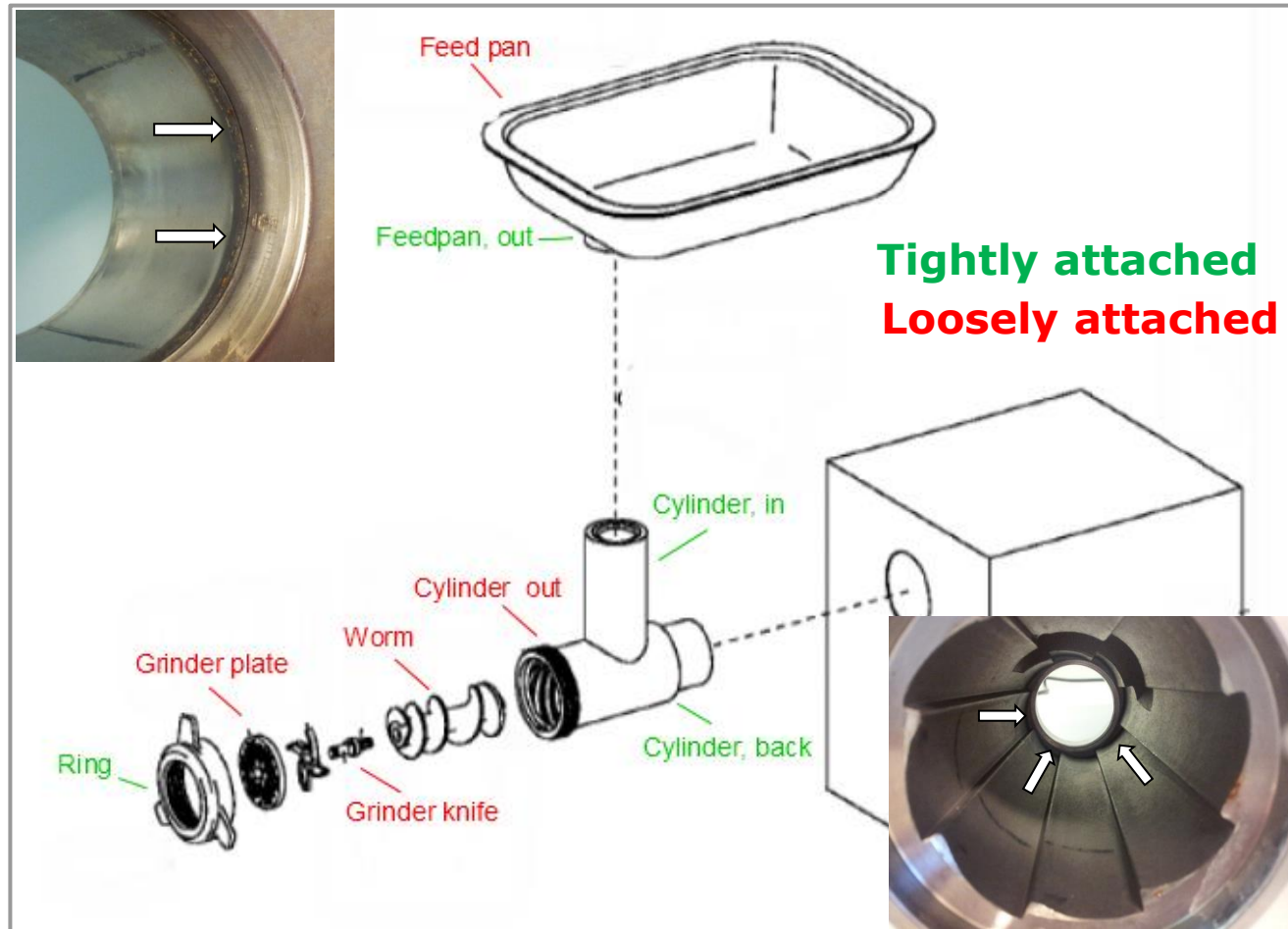
Master Thesis by
Solvej K.H. Hansen



Results – *Salmonella* in meat grinder



Physical structure responsible?



Conclusions

- The two “compartments” most likely caused by physical structure
- *Salmonella* levels appear much lower than actual level
 - Irreversible adhesion?
 - Recovery method?

